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United States Department of Agriculture,

BUREAU OF PLANT INDUSTRY,

Farmers' Cooperative Demonstration Work,

WASHINGTON, D. C.

THE CORN CROP IN THE SOUTHERN STATES.¹

The great American grain food for men and stock upon the farm is corn. Corn, intelligently managed, will produce more food per acre than any other cereal, and it is generally one of the surest of crops, which is an important item, because where men and animals must be fed certainty of production stands among the first requisites. Corn production is the basis of a cheaper food supply for the masses. Therefore the production of an abundant supply is one of the essentials of good farming.

That the corn plant is capable of adapting itself to a great variety of soils and climates is shown by the fact that it is grown to quite a considerable extent in almost every country where agriculture is practiced. The great bulk of this crop, however, is grown in the United States, and within this area it has heretofore been generally understood that, aside from the North-Central States, its production did not offer any great possibilities. In recent years the results in corn growing in the Southern States show that they are also well adapted to its production, and it is to be hoped that hereafter a great deal more attention will be given to this crop in that section than it has received in the past. The southern farmer can and should grow enough corn for every possible need of the farm. At the prevailing prices it is cheaper to produce it than to buy it, even with 12 and 15 cent cotton. Furthermore, the best farming requires systematic rotation of crops,

¹ This circular is designed to combine and replace Circular "A"—70, entitled "Southern Farm Notes," and Circular "A"—73, entitled "Crops for Southern Farms," prepared by the late Dr. S. A. Knapp. The revision and changes have been made by J. A. Evans, W. L. English, and W. B. Mercier. Helpful suggestions and assistance were given by others in the Office of Farmers' Cooperative Demonstration Work.

and corn is one of the most valuable crops for this purpose. If soil depletion and waste through washing is to be checked in the South more attention must be given to the matter of crop rotation.

Corn is a semitropical plant, and, all other things being equal, it should thrive better in the Southern than in the Northern States. This, however, has not been the case, especially when it comes to the average production. Nevertheless, it has been thoroughly demonstrated that, with proper preparation and cultivation, as much corn per acre can be produced in this section as has been grown heretofore in the corn belt. Corn requires, for the best growth, a moderately heavy rainfall throughout the growing season, a high temperature, and a large amount of sunshine. These requirements are all met in this section.

The low yield of corn in the South is due largely to the lack of care in the preparation of the seed bed. This plant requires a deep, well-drained seed bed rich in organic matter and loose enough to be penetrated by the roots to a considerable depth. It seldom yields profitably where the soil is washed badly, has not sufficient drainage, or is lacking in humus. Unlike cotton, it does not have a taproot. It has, however, a great many fibrous roots, and if the soil is in proper condition these fine branching roots will penetrate and fully occupy the ground to a depth of from 2 to 4 feet. Owing to the lack of preparation and proper drainage the southern field is seldom in shape to permit the corn roots to penetrate to this depth and the yield is materially shortened in consequence.

Experiments have shown that, while it sends many of its roots 2 to 4 feet deep, the corn plant places the great body of its feeding roots from 4 to 18 inches below the surface where the soil is made loose enough. The roots send out in every direction an infinite number of hairlike growths, which absorb moisture and food.

At the Agricultural Experiment Station of the University of Wisconsin it was found that when corn was 3 feet high the roots had penetrated the soil for 2 feet and thoroughly occupied it. At maturity the roots were 4 feet deep. At this time the upper laterals were about 4 inches from the surface.

At the North Dakota Agricultural Experiment Station the corn roots had penetrated $3\frac{1}{2}$ feet deep and fully occupied the ground 90 days after planting. (See fig. 1.)

At the Agricultural Experiment Station of the University of Minnesota the corn roots had penetrated 12 inches deep and had spread laterally 18 inches 18 days after planting. In most portions of the South nothing less than an 8-inch seed bed will insure a good corn crop, and 10 inches is safer. Some soils may require more. From 6 to 8 inches of preparation for cotton corresponds to 8 and 10 inches for corn, so far as the requirements of the plant are concerned.

In the South there has been too much shallow plowing. Breaking 3 or 4 inches is not deep enough to make a suitable feeding place for corn roots. On average land such plowing furnishes neither sufficient food nor moisture for the plant to do its best. The trouble with a shallow seed bed is that it is too wet under heavy rainfall and too dry in periods of drought.

The essential things in producing a good corn crop economically are as follows:

Good soil.—To make its largest yield, corn requires not only a deep seed bed, but a large amount of humus in the soil. Consequently most land requires some previous preparation, such as the plowing under of a green crop or the use of stable manure. The use of either of these is better than to depend entirely upon commercial fertilizers.

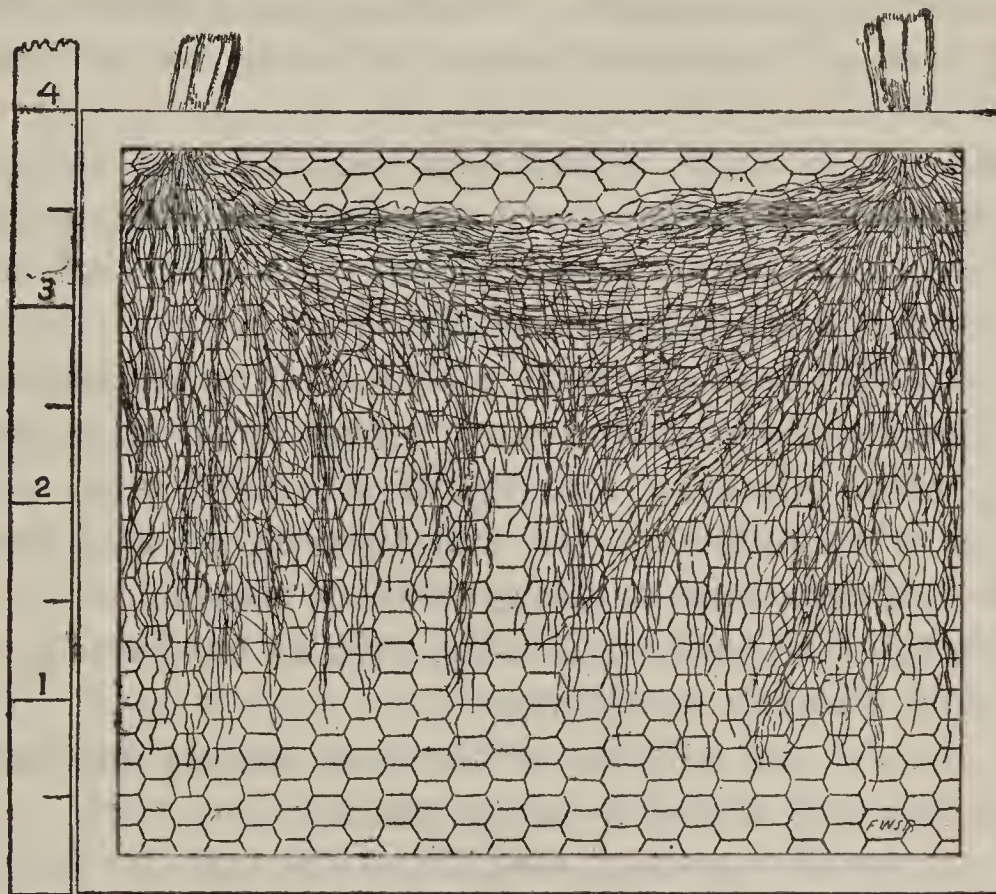


FIG. 1.—Distribution of roots of corn at the end of 90 days.
(From Farmers' Bulletin No. 233.)

The land should also be well drained, because standing water even at a depth of 1 foot below the surface prevents the corn roots from deeper penetration and renders the soil unfit for plant growth.

For corn select a well-drained piece of land filled with vegetable matter. Even if the soil has a fair amount of vegetable matter in it good crops of cowpeas turned under in the fall or vetch or crimson clover turned under in the spring will greatly increase the yield. In case this can not be done a good application of barnyard manure or leaf mold from the forest, applied in the fall or winter, will aid the crop.

It is not economical to grow corn on poor land. Such lands planted to peas, beans, or other forage crops will produce more feed and at the same time improve rapidly in fertility. Corn grown on very poor soils is an expensive farm crop.

Plowing.—Break in the fall as deeply as possible with some implement that will not bring too much of the subsoil to the surface and thoroughly pulverize. The plowing should be followed with such tools as will put the seed bed in proper condition by planting time. In preparing the land for planting, the aim should be to fine the soil thoroughly, deep enough for a good seed bed, smooth the surface by pulverizing all clods which are likely to interfere with planting and early cultivation, and if necessary compact the sub-surface so that the roots will have a good feeding ground. This will put the land in condition to absorb heat, admit air freely, and keep the capillary moisture movement in progress.

A very deep seed bed well filled with moisture is of more importance in the South than it is in the North because of the higher temperature and consequent greater evaporation. There is also greater danger of prolonged periods of drought during the critical growing stage of the plant.

In sections where there is sufficient rainfall and the plowing is done early enough, a winter cover crop of rye, oats, or barley may be sown. This crop may be pastured during winter and early spring and turned under shallow before planting time.

Preparation.—Go over the land with a disk or section harrow two or three times before planting and repeat with a section harrow immediately after planting and again after the corn is up. The object sought is to pulverize the soil thoroughly and thus prevent the formation of any crust or the growth of weeds.

Seed.—Use the best seed, especially such as has been grown under similar soil and climatic conditions.

The seed should not only be of the best variety but carefully selected in the fall and stored in a dry place.

It is not advisable to select seed from the crib or even from the ordinary field if the best results are to be obtained. There should be a special plat of a few acres for seed purposes, which should receive careful preparation and be planted with the best seed obtainable, and the crop should be given good cultivation and fertilization. Then, before the pollen has matured, all barren, weak, and diseased stalks should be removed, leaving nothing but strong, vigorous, well-eared stalks in the field, because corn is fertilized from the pollen of the surrounding plants. Therefore the selection of a medium ear from a field where the average is good is better than the selection of a model ear from a field where most of the corn is inferior. Much depends also upon the vitality of the seed. To insure high vitality, corn must be gathered early, put in a dry, well-ventilated place, and kept free from weevils. Corn is especially responsive to good treatment and careful selection. It is a crop easily improved, but deteriorates with great rapidity as a result of bad management.

Testing seed.—Seed corn should be tested for germination before being planted. Poor stands of corn may be attributed largely to the planting of seed of low vitality.

It is the general impression that there is no need of testing seed corn in the South. Experience has shown, however, that there are a great many ways in which the vitality of seed corn may be impaired, aside from heavy freezing. Perhaps there is as great a loss from poor stands resulting from the use of inferior seed in the South as there is in the North.

In order to make a test of any value it should be made before the corn is shelled, so that the ears showing a lack of good, vigorous germination may be discarded.

A simple method of testing seed corn is to place the ears on a table or convenient place and remove a half dozen kernels from different parts of the ear. Be sure to number the ear, the removed kernels, and their place in the box so that they will correspond. Secure a box of sufficient size and depth, fill with several inches of moist, light soil, setting off the divisions distinctly. Place kernels from each ear in division marked with same number. Cover with soil or suitable cloth. Sufficient moisture must be supplied and the temperature kept regular at between 60 and 70 degrees. At the end of the sixth or seventh day the sprouting should show which ears are to be planted. Full directions for testing seed corn may be found in Farmers' Bulletin 415, entitled "Seed Corn."

The irregular kernels at butt and tip should not be used for planting. It is impossible to get a machine to drop the grains with any uniformity if they are not regular in shape and size. Badly weevil-eaten corn should never be used for seed.

Spacing.—Only general advice can be given in regard to the best methods of planting and the proper spacing of corn under varying conditions. The three most common methods of planting corn are checking, drilling, and listing.

(a) On level, well-drained lands under medium rainfall planting corn in checkrows is probably the most economical. For checkrows, $3\frac{1}{2}$ feet to $3\frac{2}{3}$ feet each way appears to be generally accepted as the best distance. The number of stalks to the hill should vary from two to four, depending on the fertility of the land and the supply of moisture. Where ridging is necessary to provide for surface drainage, checkrowing is not practicable. This condition may be met by drilling the corn in the rows, which should be placed wider apart.

(b) Drilling is not recommended for land that is foul, on account of the difficulty of keeping the weeds in check. For ordinary soils in the South with average rainfall the rows should be from $3\frac{1}{2}$ to 4 feet, with one stalk in the hill ranging from 12 to 24 inches apart.

On highly fertilized soil the distance in the row may be decreased and on special prize acres a distance of 6 inches has given the best yield. The spacing of the prize acre for 1910 was rows $3\frac{1}{2}$ feet apart and distance in the row 6 inches. Prolific corn was planted and the yield was $228\frac{3}{4}$ bushels on 1 acre. In some sections where rainfall is deficient or the soil thin it has become the practice to plant corn in alternate rows with cowpeas, peanuts, or other legumes. When planted by this method the rows may be from 6 to 7 feet apart and the plants are left much thicker than where all the rows are planted to corn.

(c) On the sandy hill or ridge lands of the South, planting in the water furrow is practiced with good results. This method has not been found satisfactory on stiff clay soils or bottom lands, but has generally given good results on sandy lands and those having a permeable subsoil.

In the drier section west of the Mississippi River listing is a common method of planting corn. The ordinary practice is to let the field stand until spring, and then plant the corn with a lister without any previous preparation. This custom can not be recommended. The land should be plowed to a good depth the fall before, in order to conserve moisture and get a good seed bed. Where it is not desirable to flat-break the land, the lister may be run in the fall and the field harrowed during the winter. In the spring split the ridges with the lister, and plant.

Whether the land should be bedded, flat-planted, or planted below the surface depends on conditions of soil and climate. It is absolutely necessary to provide a well-drained seed bed before planting. If the soil does not furnish this naturally, then bedding is essential.

Depth of planting.—It is not possible to give an absolute rule for depth of planting. The time of year, the kind of soil, and the weather conditions should govern the depth of planting. Very stiff clay soils lacking in humus should be planted shallow. If planted too deep and a heavy rain follows, the surface will pack and prevent the plants coming to a stand. Lighter soils, especially those containing sand, should be planted deeper to insure sufficient moisture for germination.

Early planting should be shallow, for in the early spring only the surface soil is warm enough to sprout the seed. As the soil warms up, the depth of planting may be increased. The drier the region the deeper the seed should be placed in the soil, especially when the planting is done late in the season. As a rule farmers plant so deep that germination is retarded and the stand destroyed.

Cultivation.—The harrow or weeder should be run over the corn once or twice after it has come up to a stand. The first working with the cultivator may be deep and thorough. Thereafter intensive, shallow cultivation should be practiced. A soil mulch should be

maintained at all times if practicable. The depth of the soil mulch depends on conditions. Where the average annual rainfall is 35 inches or more the mulch need not be more than 2 to 2½ inches deep. In sections of less rainfall and where droughts are common the mulch should be deeper; in extreme cases from 3 to 4 inches may be necessary. A mulch of the desired depth should be established while the corn is young. Do not attempt to deepen it later in the season. The mulch should cover the entire space between the rows and be kept at a uniform depth. No tool leaving a bare space should be used in cultivation. The cultivation should be kept up at intervals of 7 to 10 days and always as soon after each rain as possible. More corn will be made if the cultivation is continued until the crop is fully made. The tendency is to lay by corn too soon.

USE OF FERTILIZERS.

The importance and value of stable manure and vegetable matter in making the corn crop can not be overestimated. Where an abundance of these can be obtained it is not advisable to use commercial fertilizers extensively.

Where there is plenty of humus in the soil no commercial fertilizer should be applied until the corn is 1 foot high. At this time apply a mixture of one-half high-grade acid phosphate and one-half cottonseed meal, at the rate of 250 pounds per acre, or the same quantity of commercial fertilizer called 10-3-2 (acid phosphate, 10; nitrogen, 3; potash, 2). This should be sufficient for a common field crop of corn.

On lands that would generally produce 20 to 25 bushels of corn to the acre, apply 250 pounds of the above-mentioned fertilizer, well mixed with the soil in the rows 8 or 10 days before planting. When the corn is 2 or 3 feet high apply 250 pounds, one-half acid phosphate and one-half cottonseed meal, on the sides of the rows, just before cultivation. This makes a total of 500 pounds per acre on average lands. This double fertilizing is advised only when necessary to crop such lands in corn. It is advised that lands which will not produce 30 or more bushels of corn on an acre by the application of 250 pounds of commercial fertilizer should be seeded to buckwheat, cowpeas, or crimson clover and the crop turned under until the land will produce such yields.

TOOLS AND IMPLEMENTS REQUIRED.

High-priced labor and generally changed conditions make it imperative that more and better farm implements be used on every farm, whether large or small in area. No man can farm to best advantage without at least a good breaking or turning plow (a reversible disk

is preferable, see fig. 2), a disk harrow, a section harrow, a good combination planter, a weeder, and suitable cultivators. The above are essential, and if the size of the farm and the means of the farmer will allow it many other convenient labor-saving tools can be added.

MORE HORSE POWER NECESSARY.

To use more horse power and less man power per acre or to quit farming is a necessity confronting the southern farmer.

There should be more mares on the farm. In the future few small farmers will find it profitable to keep mules. The colts must pay for the expense of using more horse power. In this connection, the more economical feeding of work stock on the farm is of primary importance. Feeding a horse or a mule on pulled corn fodder and corn is

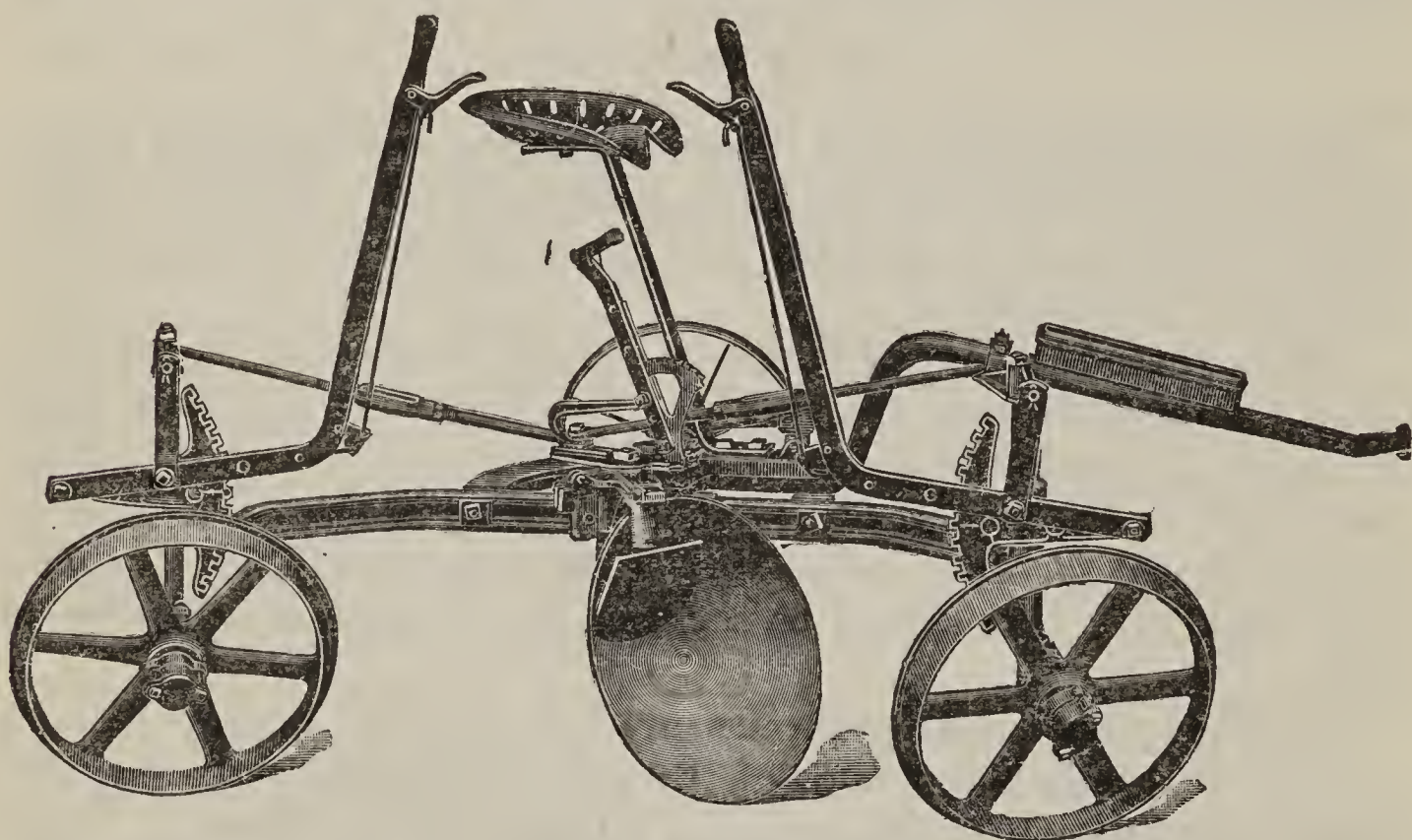


FIG. 2.—A disk plow, an excellent implement for deep fall-breaking.

so expensive and out of date that it is surprising to find anyone doing it.

The experience of the best farmers has fully proved that pasture for summer and well-cured hay for winter should be the main reliance. By a pasture is not meant a brush patch or a field of weeds, but a tract of land well set in nutritious grasses and so located as to be usable at all times.

COMPANION CROPS.

Not until recent years were the legume crops considered as a part of the corn problem in the South.

COWPEAS.

The cowpea is the best known and most generally used of any of the legumes. Its importance and value is not yet appreciated except by a limited number of farmers. The fact that they can be

grown under so many conditions and upon such varied soils should lead to their more universal use on all farms. While the common practice of sowing from half a bushel to $1\frac{1}{2}$ bushels per acre in corn middles at the last working has given satisfaction under some conditions, other methods for using them are to be preferred.

To make a paying crop by sowing at the last cultivation the soil must be fertile and the rainfall sufficient to insure an abundance of moisture. In the drier sections of the South and upon all poorer soils a good practice is to plant corn and cowpeas in alternate rows and cultivate both crops alike. The corn may be left thicker in the drill, which will in a large measure make up the average number of stalks per acre. As has already been suggested, it will be more profitable to plant thin soils to cowpeas alone for one or two seasons and then follow with corn and cowpeas. When cowpeas are planted alone on thin land it should be well broken and thoroughly prepared before seeding. Lack of preparation accounts for many poor yields in cowpeas as well as other crops. To insure early forage as well as a crop of grain the New Era or Whippoorwill varieties may be planted just as soon as the soil is warm enough in spring to allow rapid growth. Drill 3 feet apart with a corn planter, using one-half bushel of seed per acre. Cultivate well, and to insure rapid growth and fruiting use 200 pounds acid phosphate and 50 pounds cottonseed meal per acre, drilled in a week or 10 days before planting. For later planting and in the corn use Clay, Unknown, or some one of the more vigorous-growing varieties.

Hay made from cowpea vines will furnish a complete ration for growing stock and for the work stock as well when not at heavy work.

Recent investigations have established the fact that cowpeas are subject to wilt and root-knot. For this reason, where these diseases prevail, cotton lands should not be planted in any but wilt-resistant varieties of cowpeas or cotton. Velvet beans, peanuts, and the Iron and Brabham varieties of cowpeas are wilt resistant. When your cotton lands are affected with these diseases write for special instructions or for the circular of the Bureau of Plant Industry entitled "The Control of Cotton Wilt and Root-Knot," bearing the document number 648.

COWPEAS AND SORGHUM.

Cowpeas sown with sorghum on rich land will produce very heavy crops of feed. One-half bushel of sorghum to 1 or $1\frac{1}{2}$ bushels of peas sown broadcast is about the quantity to use. Amber sorghum and one of the bunch varieties of cowpeas will mature earlier, but for heavy tonnage Orange sorghum and some of the running varieties will be found best.

SOY BEANS.

In many sections the soy bean has proved a most desirable crop. At the Tennessee Agricultural Experiment Station it has given great satisfaction, both as a forage plant and in producing grain. In some comparative tests in feeding stock at this station, where it was used as a supplement to corn, no other crop has been found equal to it.

The soy bean fruits heavily, and the grain is very rich in protein and oil. It produces forage equal in food value to any of the legumes. The plant is of upright growth and will stand more cold and wet weather than cowpeas. It may also be planted earlier or later than cowpeas, with the assurance of getting a satisfactory yield of grain. The seed is not so readily attacked by insects as the cowpea, but is especially liable to damage from heating when cleaned and stored in bulk. The upright growth makes harvesting by machinery possible. The seed ripens evenly; consequently the maximum amount of the crop may be saved. An ordinary wheat thrasher may be used for cleaning them, which is not the case with the cowpea. The grain is much longer in decaying under adverse weather conditions than the cowpea, and is usually better for hogging or feeding off in the field, but it is not adapted to as wide a range of soil as the cowpea, nor is the germination of the seed usually as satisfactory. The cowpea is superior to the soy bean for sowing broadcast. One other disadvantage is that where sown in small quantities rabbits will destroy a large number of them. It is not so well adapted to growing with sorghum or corn as the cowpea, and usually loses more of the leaves in curing than the cowpea. The Mammoth Yellow or Medium Yellow have been found the best varieties for producing in the Southern States.

When grown with corn it is best to plant the cowpeas and soy beans in alternate rows and cultivate the two crops alike. One-half bushel per acre, sown in rows, is usually sufficient when the seed is good. When sown alone on the land they improve it quite as rapidly as the cowpea vines and may be planted in rows about 3 feet apart, using from three-fourths of a bushel to a bushel per acre. They will make a heavier yield of both forage and seed when planted early in the spring, although they may be planted as late as August 1. One peculiarity about them is that seed will form on the plants about the same time, whether they are planted in May or August. The size of the plants and the quantity of fruit varies very much with the date they are planted.

We think this crop is sufficiently promising to justify every farmer to try out a patch on his farm and, if it is adapted to its growth, it will be found a most valuable addition to the corn crop in helping

toward the economical feeding of his farm stock. (See Farmers' Bulletin 372, entitled "Soy Beans.")

PEANUTS.

The value of the peanut as a hay and food crop has never been fully appreciated. However, this crop is rapidly becoming one of general farm importance.

In the Southern States peanuts may be grown under a wide range of conditions and they may be used for a variety of purposes. They are valuable as a substitute for cowpeas when the latter do not thrive for any reason. They may be grown for forage after the removal of the grain crop and either mowed or pastured off. The peanut is also used quite extensively to take the place of cowpeas in planting between corn rows. They should be planted and cultivated in the method described for cowpeas. (See Farmers' Bulletin 431, entitled "The Peanut.")

VELVET BEANS.

The velvet bean has been known in a limited way in Florida for 25 or 30 years. Until the past 10 or 15 years it was grown only as a cover crop for trellises and to cover unsightly places and in some instances as an ornamental plant or curiosity. In recent years it has come into prominence as a forage-producing, soil-improving crop of no little importance. Experiments in Florida and along the Gulf coast and the South Atlantic coast in the Southern States have shown that it surpasses any of the other legumes in the luxuriant growth of foliage, which will rapidly fill the soil with nitrogen and humus.

The leading features that commend the more extended use of this crop are its heavy growth on poor sandy or clay soils, the comparative cheapness of the seed (a bushel planting from 2 to 5 acres), the ease of cultivation, the unusual amount of animal food produced, and the extended time which may be taken in harvesting it in the field by the stock, this time frequently extending through the fall and winter. The root and vine growth under favorable conditions is nothing less than marvelous.

The necessity for a long growing season prevents maturity of seed farther north than the Gulf States. The plant will make a splendid growth anywhere in the cotton belt and may be grown even farther north for hay and for enriching the land. On very poor land it may be planted in rows 3 to 4 feet apart, the beans 12 to 24 inches in the drill. Cultivate until vines are too long to allow a team to pass through them. Grown in this way it will afford a complete cover and choke out any weeds or grass on the land. If a little sorghum is planted along with it, it will help support the plants, insure better growth and the formation of more seed pods.

The planting may extend from April to July, but for producing seed they should not be planted later than May 1. Velvet beans may be sown in corn middles at last working for a cover crop as late as June 1. If planted in alternate rows, as recommended for cowpeas, the seed may be planted after the first cultivation of the corn and then the two crops cultivated together thereafter. When planted this way early in the season they make a very heavy vine growth and also produce good crops of grain. There is danger of the vines over-running and damaging the corn on rich soils or in a wet season. From the experience of farmers in Florida, Louisiana, Mississippi, and Alabama a more extensive use of this valuable addition to the legume family should be encouraged. (See Bulletin 141 of the Bureau of Plant Industry, United States Department of Agriculture, and Bulletin 102 of the Agricultural Experiment Station of Florida.)

FINAL SUGGESTIONS.

It has been found that as much or more corn per acre may be produced on the thinner soils by the alternate row system, where one of the legumes mentioned in this circular is used, than under the old method where each row is planted to corn. Where the crops are grown together the corn should be gathered early and stock turned into the field to utilize the other crops. If tight fencing can be used, pigs as well as other stock can be turned in and they derive much benefit from the loose grain which the other stock can not get. As soon as the crop of cowpeas, beans, etc., has been grazed off well, break the land, sow it to oats, vetch, rye, or crimson or burr clover to occupy the land during the winter and be turned under during the spring. This plan will economically improve the soil and increase crop production.

In sections where the season is too short to carry out the foregoing plan, vetch, rye, or crimson clover may be sown in the corn during the late summer or early fall, turning it under in the spring. This will build up the soil and is more economical than the use of large quantities of commercial fertilizers. The main object is to keep the land occupied summer and winter, producing something of value for feed or fertilizer, and at the same time greatly protecting the soil from washing and leaching by the heavy rains of winter and spring.

BRADFORD KNAPP,
Special Agent in Charge.

Approved:

Chief of Bureau.

FEBRUARY 12, 1912.



